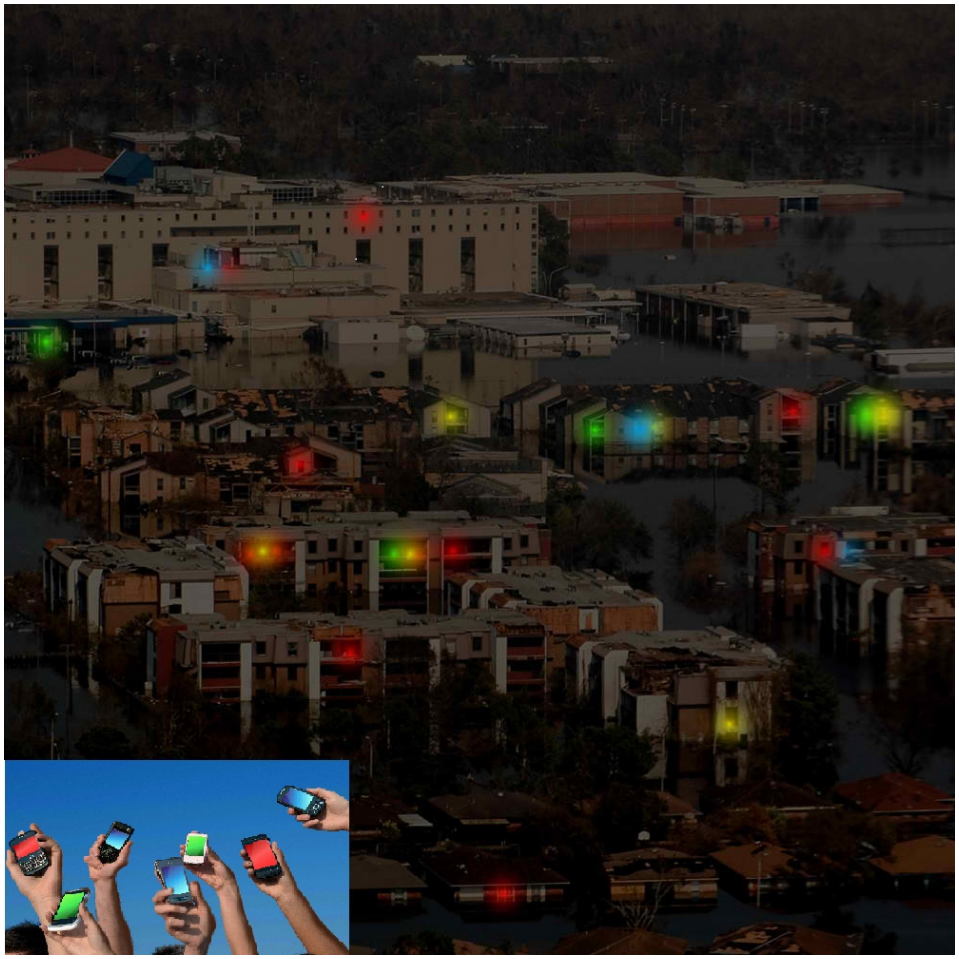
# 1. 21st Century SOS



## Principal Investigator

Juan Cienfuegos, Southwest Synergistic Solutions, LLC

## Capability Area of Interest

Decision Support(DS), and Situation Awareness (SA) and visualization

## Capability Description

This experiment proposes to explore how much more effective drones can be during search and rescue operations if a new post disaster survivor visual signaling system is established. The hope is that survivors will be found faster and responders will be more effective with the provided visual information. SOS was first recognized in 1905, we are in 2017. Most of us carry a device with a screen, our phones, IPads, smart watches, etc…, this makes the system practical. Those screens do not require external power and will function even if networks are down. Given the fact that 12 of 24

hours on average are dark having a system to work reverse cycle in a more effective manner can result in many more lives being saved after any major disaster. The capability we propose to explore is a color coded, (red = children, green = special needs/handicapped, blue = adults, yellow =pets, constant signal = I'm OK, flashing signal = I need medical assistance), system working in conjunction with drones at night improve the overall safety, performance and accountability of the responder, while also resulting in survivors being found and extracted faster and more effectively.

## Experiment Hypothesis and Objectives

This experiment intends to prove that by providing disaster survivors with a new emergency visual signaling method that search and rescue outcomes will be improved. Currently SOS is the only visual signaling standard that is recognized for emergencies. SOS was great for 1905 when white light and flappers were the best available technology but we are in 2017 and the technology we carry with us all the time is capable of conveying so much more than simply "I'm here, in distress". By using a color coded system we can utilize UAS's, helicopters, airplanes, or high ground to look for the visual signals and make note of the information (location, condition, survivor group composition). Simply put, there is a difference when it comes to the rescue of adults and children. Adults are more knowledgeable about their surroundings and threats to their safety, capable of following evacuation commands, familiar with rescue operation equipment and gear, capable of self-evacuation (provided the adult is not injured) and capable of communicating vital information on other survivors, locations and threats. Children, on the other hand, are 1) less likely to take notice of the threats to their surroundings, 2) may have difficulty self-evacuating, 3) may have difficulty following evacuation commands, 4) may be unfamiliar and afraid of the sights and sounds following a disaster, 5) may be unable to communicate effectively to aid rescuers or 6) require additional equipment necessary for evacuation. Having this information prior to attempting a rescue allows the rescuer to focus on the needs of that particular survivor and increases the likelihood of a safe and life-saving rescue. Not only can the 21st Century SOS system benefit survivors and rescuers in the examples provided above, it also recognizes the needs of the special needs community. By incorporating a specific color-code for special needs people, rescuers can be prepared to assist the specific needs of the disabled-survivor by having appropriate evacuation equipment, medical support devices, medicine or the like with them when they find the survivor. We intend to prove that you create a synergy when you combine the capabilities of "earth to sky" technology (screens) with "sky to earth" technology (drones) that will result in more lives being saved more effectively and safely.

## Experiment Plan / Data Collection Plan

X number of personnel will be situated throughout the mock uninhabited urban environment and empty field in both daytime and nighttime settings. Each participant acting as a survivor will download the free Visual 911+ app.

During the daytime there will be three runs utilizing drones and people in a search and rescue exercise. In the first run no one of the survivors will utilize a visual signaling device. The time it takes for the search and rescue teams to find and then extract all the survivors will be noted. In the second run, with a second team, survivors will be allowed to use visual signaling devices of all sorts to signal,

including flashlights and SOS. The times to locate and extract all survivors will be noted. In the last run, with a third team, survivors will all utilize the Visual 911+ app. The time it takes for the SAR teams to find and then extract all the survivors will be noted.

The same three scenarios will be run at night and the times will be noted. Each responders answers to a questionnaire will also be noted and evaluated.

Once all the data is in, it will be analyzed and reported on. The answer this experiment will answer is, will a synergy be formed when people actively and in a standard way interact with drones for the common good, result in substantially improved outcomes when it comes to search and rescue.

### Measures of Performance/Effectiveness

The measure of performance will be the times to locate, extract each and every survivor along with the results of the responders feedback to a questionnaire. The questionnaire will focus on what their expert opinion is regarding having the additional information provided by the survivors via the screens. The effectiveness measures will be if the responders answer that there is an additional benefit to knowing the additional information on the survivor they were coming upon. Did it better prepare them to have the easiest and fastest possible experience? The times from start to finish will also provide a lot of information.

### What new capability does this represent?

This experiment a rather simple and common sense approach to improving search and rescue outcomes. I once was asked, if this system was so effective why was it not used during Katrina? That led me to do some research and I discovered that coast guard pilots had recognized flickers of lights coming from rooftops as humans and that that led to days of rescues. Now imagine if the system was standardized and everyone had access to participate. Knowing you are coming upon a special needs person allows you to know that simply screaming “follow my voice” may not be enough because now they know this person may be deaf. Or if a person is blind you cannot simply expect them to follow you. What if they are wheelchair bound, you will need additional resources.

### What capability gap does this address?

Location, Tracking and Communication Technologies, is addressed by confirming a simple color coded system of visually tracking survivors that are communicating their general description (child, special needs/handicapped, adults or pet) and location to aid first responders be most effective. As far as, Social Media for Situational Awareness, the visual 911+ app can have a set email specific to a responders organization FB account and be able to transmit their alert status, general GPS location and instructions to zone in by looking for the visual signal from the screen. Regarding, “Tracking solutions for GPS denied environments”, the Visual 911+ app allows for visual tracking even if power or networks are out. You do not need GPS to be seen.

### Quantitative Results:

One of the areas this experiment proposed to explore was how much more effective drones can be during search and rescue operations if a color coded post disaster survivor visual signaling system is established.

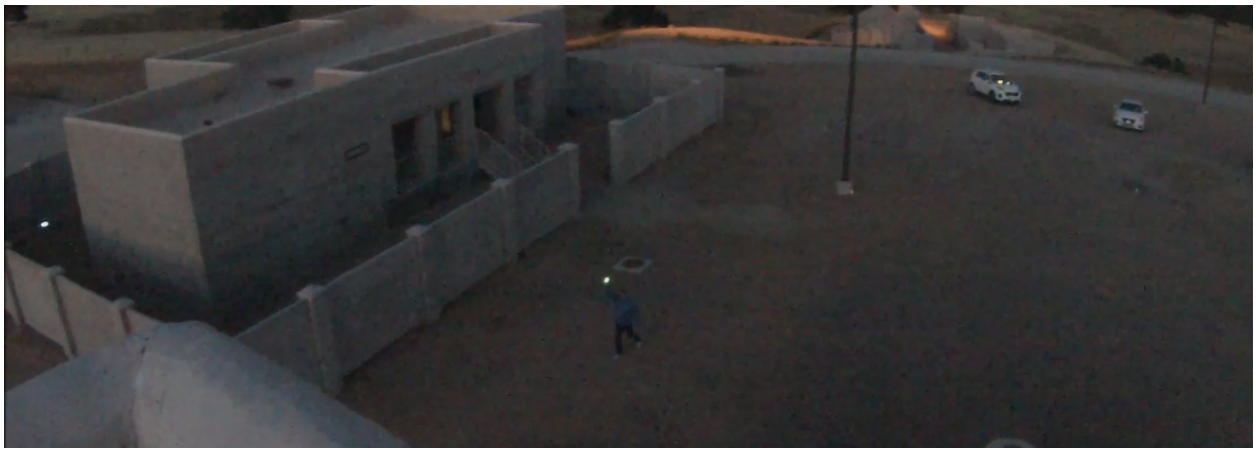
It was hoped that drones could be used during this experiment, but unfortunately no nighttime flights were authorized. For this round of experimentation high ground was used instead. More specifically the roof of the “Hotel” found at the CACTF. It had the highest view point.

Several laptops and cellular phones downloaded either, the “Disaster ID” app, an outdated color code is used in it, and the “Visual 911+” app that includes the latest proposed visual signaling color code. The post disaster code follows, red = children, green = special needs (handicapped), blue = adults, yellow = service animals/pets, and white is a catch all color. Flashing screens = “I’m here in need of medical assistance”, constant screens = “I’m here but OK”. White is included as a catch all color for those caught without an app or the ability to change the color of their screen, to use everyday flashlights or keychain lights, in order to still participate in the system, and at minimum convey their location and condition.

Due to limited resources and time available for nighttime experiments, the proposed multiple rounds in the day time and night time conditions were not conducted. The rounds were to time, the time it took for a drone to locate multiple survivors, was not conducted. In one round the survivors would use t-shirts, towels, hands, anything they could use, and in the other they would use their cellphones screens, laptop screens, and flashlights to signal their location, condition, and group makeup. Then the time differences would be compared.

Instead, this experiment focused on the participants’ personal visual impressions and opinion, as well as camera sensor data looking in IR, EO, and fused wavelengths. CMU was used a technology before the human eye did.

After reviewing images and video, the visual signals coming as far as the village, at the furthest distance from the Hotel, were viewable. If NPS personnel know the distance from the Hotel roof to the village/condo complex at the bottom of the hill, we can know the approximate maximum distance the signal could be observed. Following is a picture showing the signaling in the system.



There are six signals. Can you find them?

All the illuminated targets were viewable. It was more difficult to see the illuminate screens located in lighted rooms. Confirming the distances to the different buildings would aid in quantifying distances and possibly gather data as to color distinction at the different distances from the video and images taken.

By asking the experimenters from CMU we could also determine the distance from there sensor to the target they located before the human detected it, and verify that the signal they picked up was from the cellular or laptop screen. It would be interesting to know if CMU could distinguish the color.

For better quantitative results a set number of people signaling must be tracked, their distances and signaling color must be known. Times should also be taken where in trial 1, no screens are used and in a trial 2, screens are.

## Qualitative Results:

It was obvious that the visual signals could be seen with the naked eye from various distances and angles. High definition cameras with good zooming systems should do even better.

Following is the feedback I have received to date:

"Juan,

I don't have time to upload the video just now. But in terms of feedback, I'd say that it is important for you to flash the screen in a recognizable pattern (e.g. SOS in morse code) — this would make it much easier to distinguish the cellular phone screens from street lights and other light sources.

— Bob"

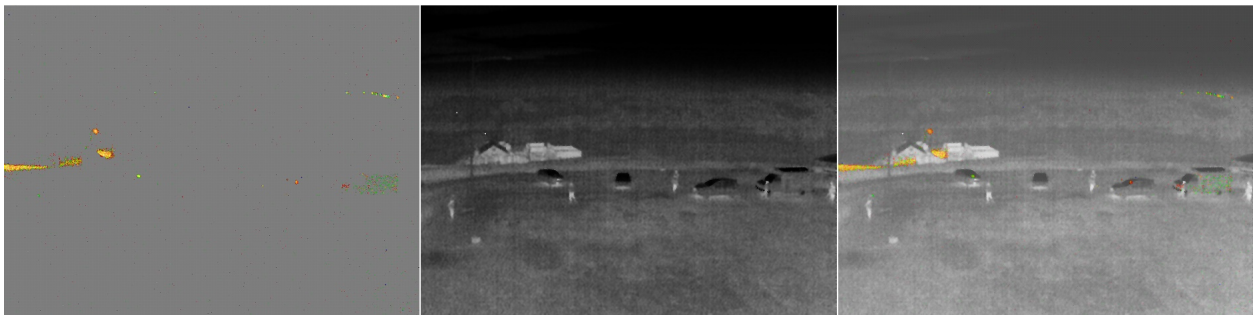
_____

Bob Iannucci, Ph.D.
Distinguished Service Professor, ECE
Director, CyLab Mobility Research Center
Carnegie Mellon University

The above observation and comment by Dr. Iannucci raises an important point. What I have noticed is if power and networks are out, so will the street lights and building lights. I further believe that street lights and most home lights are white and could be distinguishable from signaling survivors. In the end, what Dr. Iannucci suggested may be a good feature to incorporate in future versions. For example, have different flashing rates for children, special needs, adults, and pets. Maybe one day have specific flash patterns for different disabilities. For the time being, it may be best to keep the post disaster survivor visual signaling system as simple and basic as possible.

Following is feedback from one of the Teledyne team members:

“The layout below is as follows: left=visible(EO), center=IR, right=Fused.



As you may have overheard us discuss, we had an unfortunate mishap where because of the cold weather, the camera was not responding well. In this case, it caused the EO channel to have very poor response. However, it was successful in capturing the cellphone/table lights (along with tons of noise and saturation under the light posts). What this set of images shows is that the color lights are extremely effective in identifying people based on the state of their light. It also shows that the IR is indispensable for night operations as it helps provide situational awareness. As you remember from when you were up on the roof with us, it was hard to see people and especially whether they were standing, sitting, etc. The fused image on the left, which combines the EO and IR, exemplifies the benefits of fusion as it provides a “full situational awareness”. I believe the person on the far left is you holing the light up in the air as you were swinging your arm (I could see this in real time!). Unfortunately I am now noticing that when I compressed the image for email, the second person from the left appears to not have a light but in fact they are and it is blue. You can also see the green and red flashing lights through the windshields of the first and third vehicle from the left.

More to come once I’ve had a chance to go through the data.

You can use my address below my signature. Thanks!

Cheers,
Mario Aguilar-Simon, Ph.D.
Principal Scientist
Information Sciences
5001 S. Miami Blvd. Suite 200
Durham, NC 27703
919.323.3485
Mario.aguilar@teledyne.com”

## Data Questions

What does your data represent? (e.g. IR Video, track data, text, etc)

Images, video, text – feedback emails

What format(s) do you use for your data? (e.g. KML files, Cursor on Target, .txt, etc)

.docx

MP4 - Youtube link

JPEG

How much data (of each type) do you collect or generate during a JIFX event? (e.g. 10GB of video)

.docx – a couple of emails included in this document

MP4 – 985,896 KB

JPEG – 180 KB and 494 KB

## Observations & Comments:

After zooming into the image provided by Teledyne it is obvious the camera not only observes there is a survivor there, but with the addition of a color coded signal being transmitted by the survivor they know the two survivors on the left are special needs (blind, deaf, mute, wheelchair limited, etc. )," and the survivor on the right is a child. This is valuable information for any responder for the following reasons:

Children are less likely to take notice of the threats to their surroundings.
Children may have difficulty self-evacuating.
Children may have difficulty following evacuation commands.
Children may be unfamiliar and afraid of the sights and sounds following a disaster.
Children may be unable to communicate effectively to aid rescuers or require additional equipment necessary for evacuation.

Having this information prior to attempting a rescue allows the rescuer to focus on the needs of that particular survivor and increases the likelihood of a safe and life-saving rescue.

Special Needs:

By incorporating a specific color-code for handicapped people, rescuers can be better prepared to respond and assist the specific needs of special needs-survivor.

Knowing survivors special needs can also ensure the number of handicapped on scene that needs specific evacuation equipment, medical support devices, or medicine when they are extracted will most likely be available.

Adults:

Adults are more knowledgeable about their surroundings and threats to their safety, capable of following evacuation commands, familiar with rescue operation equipment and gear, capable of self-evacuation (provided the adult is not injured) and capable of communicating vital information on other survivors, locations and threats.

Service animals and pets:

By identifying the location of a pet/service animal whose owner has taken the time to attach a yellow dog tag to them, that animal will have the capability of potentially leading responder to their owners.

It important to note that very young children or pets will not be carrying cellphones, but this does not preclude them from participating in the 21st Century SOS. Pet owners could buy yellow collar lights and use them for daily walks or other activities and when a disaster strikes they are already equipped. Same for very young children, parents could provide a small red light and attach it to their back backs and instruct them from an early age that if they are ever in a disaster to turn on the red light to help reponders know they are there so they can come help them.

When I spoke with Anna from NAVAIR, she asked why this app is not on every phone. I explained that I had been trying, but that it was a challenge to get a color coded system officially recognized. For example "SOS", "This distress signal was first adopted by the German government in radio regulations effective April 1, 1905, and became the worldwide standard under the second International Radiotelegraphic Convention, which was signed on November 3, 1906, and became effective on July 1, 1908. SOS remained the maritime radio distress signal until 1999, when it was replaced by the Global Maritime Distress and Safety System.[1] SOS is still recognized as a visual distress signal.[2]." Information taken from Wikipedia. So the question is. Who or what organization in 2017 has the authority to officially establish a 21st Century SOS. 1905 was over 100 years ago.

Over the years, several personal attempts have been made to get the Federal Government interested in going one step beyond simply alerting our population of an impending disaster like a hurricane, and giving our population a standardized system to communicate with responders after the disaster has struck. With the ever increase use of drones for search and rescue, and the fact that over 90% of the population owns a cellular phone, smartphone, Ipad, laptop, smart watch, etc…, the system is practical because the majority of the population is already equipped with a signaling device that is not dependent on external power or network availability. The topic itself is ranked in 1st place at the Department of Homeland Security's, National conversation website regarding the responder of the future. Here is a link, https://scitech.ideascale.com/a/ideas/top/campaign-filter/byids/campaigns/60591 . Even with the above, no one at DHS has contacted me. I have also contacted people at FEMA and have spoken with FEMA personnel in charge of the IPAWS (Integrated Public Alert & Warning System) program and have basically been ignored. No one seems to know where to go.

Additional efforts others, and myself have tried to get a 21st Century SOS officially recognized follow:

- Introduced bills to the Texas House of Representatives and Senate in 2012, 2014, and 2016. Following is a copy of the 2017 Texas House HB1598:

"85R8230 JG-F

By: Martinez H.B. No. 1598

A BILL TO BE ENTITLED

AN ACT

relating to the establishment of the disaster identification system for a state of disaster.

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF TEXAS:

SECTION 1. Section 418.004, Government Code, is amended by adding Subdivision (3-a) to read as follows:

(3-a) "Illuminated display" means a device that:

(A) displays blue, green, red, and yellow colors or the color white; and

(B) displays a flashing and a steady light.

SECTION 2. Section 418.015(a), Government Code, is amended to read as follows:

(a) An executive order or proclamation declaring a state of disaster:

(1) activates the disaster recovery and rehabilitation aspects of the state emergency management plan applicable to the area subject to the declaration; [~~and~~]

(2) authorizes the deployment and use of any forces to which the plan applies and the use or distribution of any supplies, equipment, and materials or facilities assembled, stockpiled, or arranged to be made available under this chapter or other law relating to disasters; and

(3) activates for the area subject to the declaration the disaster identification system described by Section 418.0155.

SECTION 3. Subchapter B, Chapter 418, Government Code, is amended by adding Section 418.0155 to read as follows:

Sec. 418.0155. DISASTER IDENTIFICATION SYSTEM. (a) In an area subject to a declaration of a state of disaster under Section 418.014, a person may use an illuminated display to communicate with disaster relief personnel. A person who elects to participate in the disaster identification system shall:

(1) affix to each individual and domesticated animal in the person's household an illuminated display of the following colors:

(A) if the person has a monochromatic illuminated display, the color white for each individual and animal; or

(B) if the person has a multicolored illuminated display:

(i) blue for individuals 18 years of age or older;

(ii) green for individuals with a disability;

(iii) red for individuals younger than 18 years of age; and

(iv) yellow for animals; and

(2) using the illuminated display, signal to disaster relief personnel responding to the area after the disaster with:

(A) a solid light on the display of each household member who is healthy and not in need of medical assistance; or

(B) a flashing light on the display of each household member who is in need of medical assistance.

(b) Disaster relief personnel may patrol the designated disaster area by air or ground at night to locate persons with activated illuminated displays.

SECTION 4. Section 418.042(a), Government Code, is amended to read as follows:

(a) The division shall prepare and keep current a comprehensive state emergency management plan. The plan may include:

(1) provisions for prevention and minimization of injury and damage caused by disaster;

(2) provisions for prompt and effective response to disaster;

(3) provisions for emergency relief;

(4) provisions for energy emergencies;

(5) identification of areas particularly vulnerable to disasters;

(6) recommendations for zoning, building restrictions, and other land-use controls, safety measures for securing mobile homes or other nonpermanent or semipermanent structures, and other preventive and preparedness measures designed to eliminate or reduce disasters or their impact;

(7) provisions for assistance to local officials in designing local emergency management plans;

(8) authorization and procedures for the erection or other construction of temporary works designed to protect against or mitigate danger, damage, or loss from flood, fire, or other disaster;

(9) preparation and distribution to the appropriate state and local officials of state catalogs of federal, state, and private assistance programs;

(10) organization of manpower and channels of assistance;

(11) coordination of federal, state, and local emergency management activities;

(12) coordination of the state emergency management plan with the emergency management plans of the federal government;

(13) coordination of federal and state energy emergency plans;

(14) provisions for providing information to local officials on activation of the Emergency Alert System established under 47 C.F.R. Part 11;

(15) a database of public facilities that may be used under Section 418.017 to shelter individuals during a disaster, including air-conditioned facilities for shelter during an extreme heat disaster and fortified structures for shelter during a wind disaster;

(16) provisions for quickly replenishing the food supplies of area food banks or food pantries following a disaster;

(17) provisions for the use of the disaster identification system described by Section 418.0155; and

(18) [~~(17)~~] other necessary matters relating to disasters.

SECTION 5. This Act takes effect September 1, 2017."

Why a law? Legislation is needed to give official recognition/uniformity to the system so that it helps mitigate future search and rescue outcomes. It would be difficult if East Texas adopted one color code and West Texas another and when they came together to respond to an emergency they interpret the signal differently.

To paraphrase an article titled, "How Elected Officials Can Prepare for, Respond to Emergencies", elected officials set the tone and direction in the community for prevention, mitigation, preparedness, response and recovery activities. They do so by providing policy, mission, direction and authority.

Therefore, it is important that elected officials understand what their role is prior to a disaster. They should take pre-emptive measures to mitigate or lesson the effects of disasters on their communities. Sadly many communities do not address mitigation until they are in the recovery phase of a disaster. However, it has been proven that mitigation saves money. It is documented how every $1 spent on mitigation saves society an average of $4.

- A search and rescue subject matter expert (Eddy Weiss) and others have started grass roots effort. For example Sarasota county, Florida. Following is part of a letter received which discusses how the Visual 911+ app is being utilized:

"Hi Eddy,

Happy conferencing.

I will like to thank you with my greatest appreciation for your staying with us during the week of 4/10/17 and for your presentations.

Attendees are still speaking about your sessions. My supervisor wants you back here simply on the strength of reading the evaluations
written about your presentations. Your real-life experience, evident superlative insight and relevant lessons learned are inspiring.

Furthermore, your ability to bring to our awareness, cutting edge companies who are creating innovative and critically needed supplies
and equipment in the realms of Emergency Management, EMS, Fire and Rescue is sorely needed and welcomed.

Please thank them for giving us the opportunity to see the showcase of their products.

On that note, here are what we are doing and what we need:

**What we are doing** (Keep in mind that no purchase is final until it is approved by leadership and finance)

**1.** Medical Reserve Corps of Sarasota County (MRC-Sarasota) will be rolling out the **Visual 911 +** in the following ways:

a. As one of our foundational and critical Apps to the community though our CDC and NACCHO grant funded All-Hazards Survival and Active Bystander Training Program (AHS/ABT)
b. As one of our foundational and critical Apps to the Healthcare Coalition (HCC), Community Organizations Active In Disaster (COAD), CERTs and Home Owners Association, MRC national boards and conversations, and various other groups that we partner with for disaster preparedness, response and recovery. I will also be sharing it with Pinellas County Citizen Corps and the State Emergency Management office and other relevant state-wide groups.
c. Within MRC-Sarasota we will also be using this app for our weekly and monthly communication checks-Think radio checks with the cell phone.

# About Carol Jeffers

Carol Jeffers is internationally known as a dynamic, "Forget the box", results-driven expert in the areas of Disaster Preparedness, CDC National Strategic Stockpile/Medical Countermeasures (SNS/MCM), Access and Functional Needs Disaster Planning, Volunteer Cadre program development and maintenance, and developing robust survival capabilities through strategic and dynamic partnerships among government, non-government, businesses, communities and Faith-based entities. Having earned the prestigious and highest honor of "President's Award" for her graduate studies in Emergency Management, held multiple national and state positions including Vice Chair of the National Association of County and City Health Officials' (NACCHO) Public Health Emergency Management Workgroup, earned numerous certifications through FEMA, the National Emergency Response & Rescue Training Center (NERRIC) and through her work with the National Terrorism Preparedness Institute and being a Master Trainer, Carol can speak authoritatively on a wide variety of disaster, survival, strategic planning and operations development topics. Leveraging over 30 years of field experience in disaster response, transportation and port security, soft target hardening, hospital and medical facility preparedness, development and mentoring of leaders, Active Shooter/Hostile Event survival training, Anti-Terrorism, Emergency Medical Services, and technical consulting to federal, state and local governments within the U.S. and internationally, Carol brings a unique blend of candid, interactive and high energy presentation to her programs.
Carol has been a trail breaker throughout her career; including, years spent in diverse and challenging leadership roles as a Technical Consultant for Southern Command (SOUTHCOM) Caribbean and South American projects, being a sitting member of a Carnegie Board, developing ground-breaking and internationally acclaimed programs with FEMA Higher Education Project, National Oceanic and Atmospheric Administration (NOAA), National Fish and Wild Life and the National Science Foundation. This diversity has given Carol a 360 degrees viewpoint of many critical issues. Invited often as a speaker and to conduct workshops at technical, government and private industry conferences, Carol brings this clarity when she shares real-life examples from the canvas of her experiences managing volcanic eruptions, hurricanes, mass evacuations, massive wild fires, and major events like the World

Cup, Iron Man, Olympic qualifications, annual U.S. Presidential visits and carnival. Carol Jeffers spins her stories against an international tapestry and paint them in local colors; leaving the audience with practical strategies, actionable steps and innovative solutions to seemingly-impossible challenges. Carol leaves her audiences galvanized into action.
Carol currently wears many hats for the Florida Department of Health including being the Vice Chair of the Southwest Disaster Healthcare Coalition and State Program Coordinator for Community-Based Disaster Coalitions. Carol solves challenges and build relational bridges through Management of county-level SNS/MCM and Access and Functional Needs and Directorship of the county Medical Reserve Corps. Carol is the recipient of many competitive grants including three CDC grants and two NACCHO Challenge Awards which keeps her immersed in ground-truthing data, current research and strategic programmatic changes focused on the above mentioned areas. Carol maintains her national Certified Healthcare Emergency Professional (CHEP) certification along with those related to her EMS/Rescue and trainer roles."

- The same subject matter expert, "Eddy Weiss" utilized the Visual 911+ app during Hurricane Matthew and it resulted in at minimum two reported rescues.

In closing, I believe more experimentation should be done on the 21st Century SOS. Gathering additional evidence based data to prove its effectiveness will go a long way in getting a post disaster survivor visual signaling system officially adopted. The effectiveness of the different colors at different distances, the effectiveness of waving the illuminated displays, observing the displays from different angles, and knowing the distances, is data that can be gathered in future JIFX's.

Here is a link to video of compiled video footage gathered by several GoPro cameras during JIFX 17-3. The video starts at the beginning of the exercise, mentions some of the methodology, and ends at the wrap up. Notice how dark the last minute or so of the video is (during the wrap up and when the set up lighting was turned off). I do not notice much difference of the signaling visibility when the set up lighting was on.

https://www.youtube.com/watch?v=uit-t-DP8hM

## Additional Questions:

Did you receive constructive end-user feedback on technology?

Yes. The feedback from Dr. Bob Iannucci brought up a good point regarding how to maximize the effectiveness and reduce any confusion. I still believe that the signals will come from areas where responders have not reached, and once they arrive at the location there is less confusion since the different lights are more discernable at close ranges. The feedback from Teledyne, "What this set of images shows is that the color lights are extremely effective in identifying people based on the state of their light. It also shows that the IR is indispensable for night operations as it helps provide situational awareness.", confirms the post disaster survivor visual signaling system using screens is of benefit in conveying additional information regarding the signaling survivor.

Did you discover additional capabilities with could be included in your technology?

Yes. I now can state that when using Teledyne's EO imagine technology, not only can you visually identify a survivor but you can also differentiate between colors and gather additional

information regarding the survivor. I also discovered, by flashing the different colors at different rates you could convey additional information. The thought had come to me before regarding triage lights and how effective they would be for a color blind responder. Having different flashing rates for each triage color code would resolve the issue for color blind responders. The faster the flash rate the more critical the priority. For example 120 pulses per minute for 1st priority (red), 60 pulses per minute for 2nd priority (yellow), 30 pulses per minute for 3rd priority, no flash for 4th priority (blue/black).

Did you discover additional applications of the technology you produced?

Somewhat. After learning the next JIFX may be focused on robotic technology I started to wonder how well the system would work inside blacked out buildings. For example there is an earthquake and robots are sent in to locate survivors. Humans are not entering because there may be building collapse concerns. Would having survivors visually signaling in a partially torn down building be found faster by robots searching the building vs. relying solely on the sensors they are equipped with.

Did you perform any on the fly development of your technology during the JIFX week?

No.

Were you provided with additional data necessary to conduct your experiment?

No, not at this time. I hope to get approximate distances from the Hotel roof to where the visual signaling targets were visible.

Were you provided with support services necessary to conduct your experiment?

Yes. Without Scott and the rest of the JIFX staff I believe this experiment would not have been conducted. Gathering various collaborators/participants to gather visual and other data was invaluable. Coming up with laptops and cellular phones to use during the experiment was also invaluable. The provision of the GoPro cameras to capture footage was also invaluable. In short, without the support and ingenuity of the JIFX staff this experiment could not have been conducted.

Did you engage in ad-hoc experimentation or collaboration with other experimenters? If so, include names of those experiments for purposes of identification.

Yes. Bob Iannucci, Ph.D. , Distinguished Service Professor, ECE Director, CyLab Mobility Research Center, Carnegie Mellon University

Mario Aguilar-Simon, Ph.D., Principal Scientist, Information Sciences, 5001 S. Miami Blvd. Suite 200, Durham, NC 27703, 919.323.3485, Mario.aguilar@teledyne.com

The person in charge of the scene lighting.

Scott Appling, Scott.Appling@gtri.gatech.edu

Did members of the Joint Vulnerability Assessment Branch (JVAB) look at you experiment? If so, please describe the interaction.

No.

What, if any, are the uniquely valuable aspects of this event?

The fact that the staff will find ways to get things done is admirable and a credit to NPG. The environment is austere but extremely creative and encourages collaboration. The JIFX personnel look at the big picture and are invaluable to the success of everyone attending. This exercise offers the opportunity to introduce new ideas and have them seriously considered and experimented for current effectiveness and ways to improve.

**Photo/Graphics (*please keep the file size to a minimum)*:**

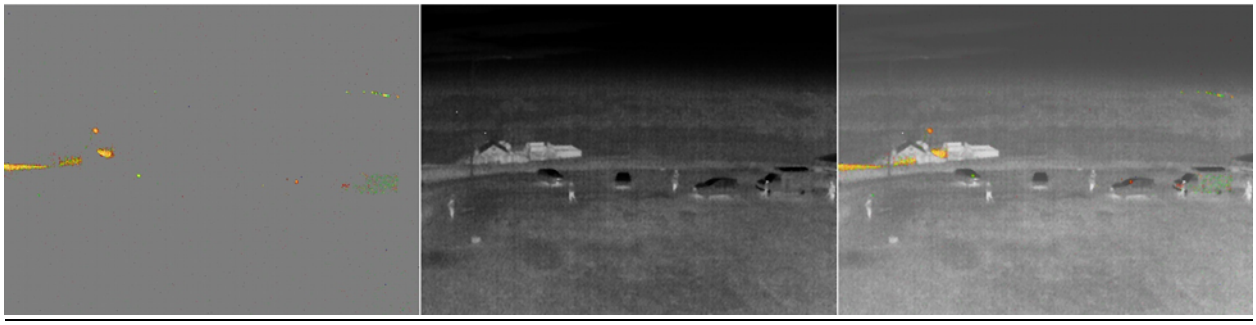
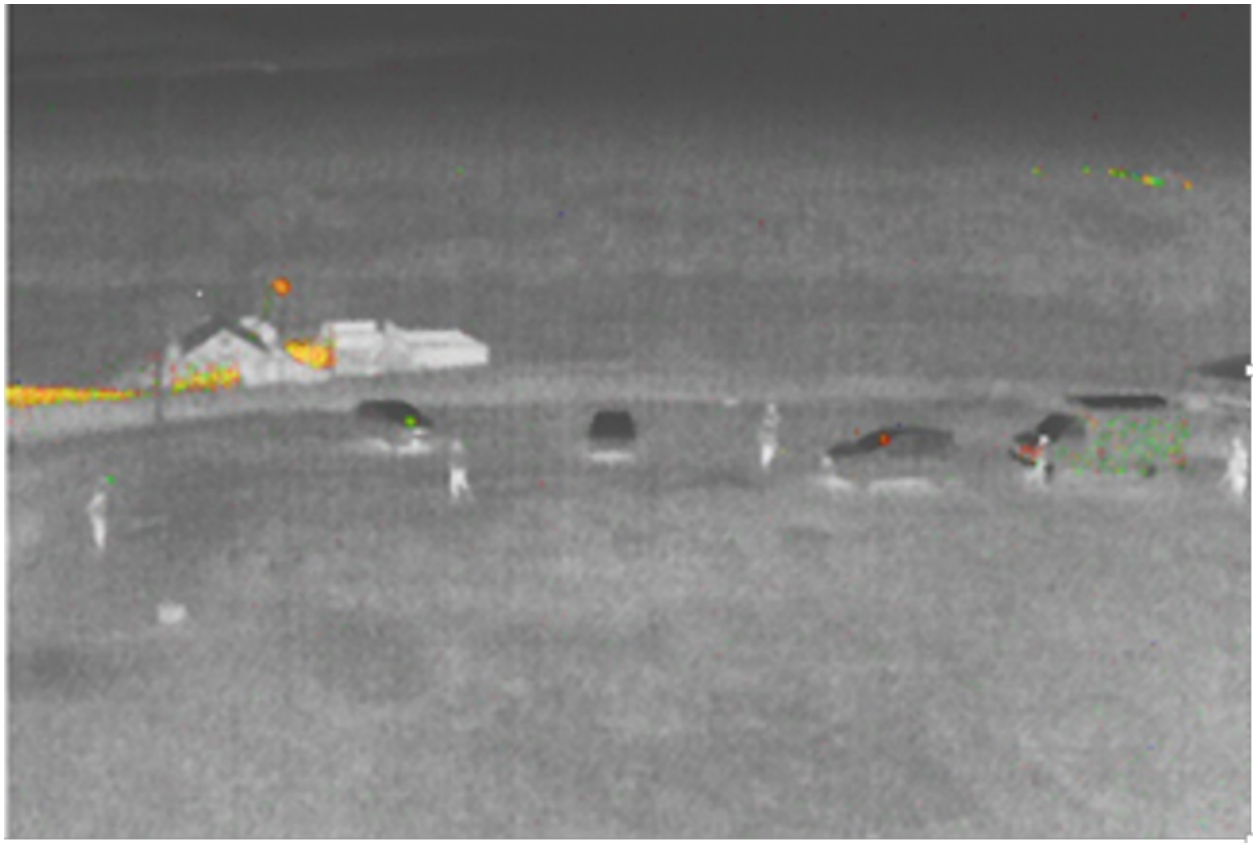


**Image taken by Teledyne: left=visible(EO), center=IR, right=Fused.**



**Enlarged fused image showing survivors and the visible colors coming from screens.**

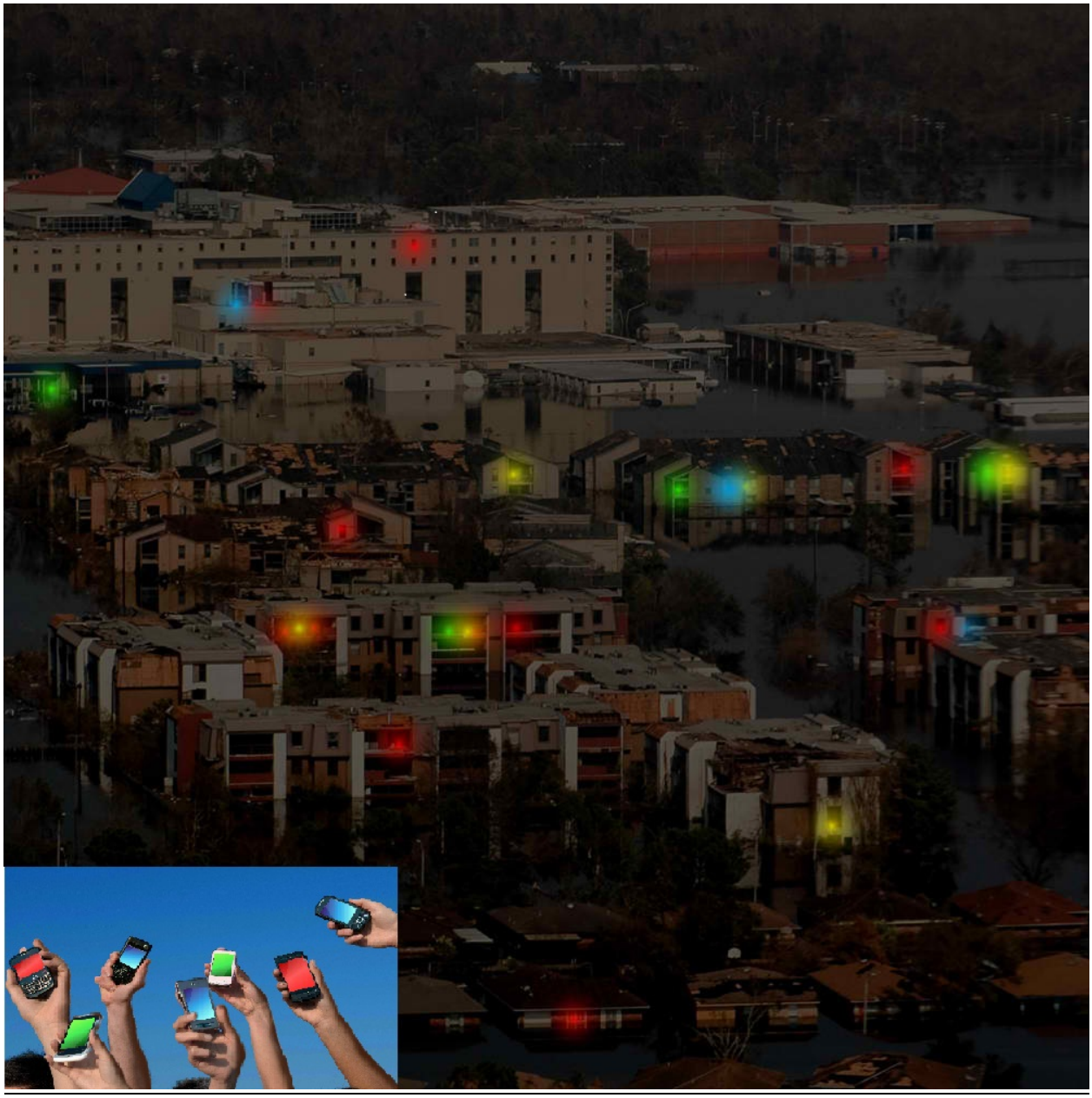


**Image convey the concept. Imagine the image without the visual signals.**

## Stakeholder Evaluation(s):

Do you consider yourself to be a Subject Matter Expert?

1. No

Is this Experiment Relevant?

1. Yes

What Areas of the RFI does this experiment relate to?
1. No Response

Additional areas not listed above?
1. No Response

How much of an improvement is this technology over existing solutions?
1. High

What are the observable strengths of this technology?
1. No Response

Additional strengths not listed before?
1. The basic idea is really a great one; provide a way for people to signal at night, while allowing rescures to prioritize ops. It is a simple approach which is good, and relies on minimal training for the population on a device many already own.

Observable weaknesses of technology?
1. No Response

Weaknesses not Listed Before?
1. These aren't as much weaknesses as observations on potential difficulty in executing this idea. You're depending on phones and tablets which means you are dependent on battery life of those devices. Not everyone has a phone or tablet.

Does this experiment aid in refining RFI elements?
1. No Response

Does this experiment represent a new approach to bridging a capability gap?
1. Yes

Did the experimenters modify current technology for a new application?
1. Yes

Did the experiments collaborate with other experiments on a potential solution?
1. No Response

Did you attend an experiment by the participant at a prior event?
1. No Response

Additional Comments
1. This idea shows real promise. My suggestion would be to instead of requiring the user to download an app, have the developers work with Apple and other cell phone developers to include this capability as part of the flashlight app that already exists.